

Rationality As a Collection of Attributes:

Theoretical and Methodological Implications of Schelling's Theory of Rational Behavior for Cognitive Economic Theory

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Abstract

One of the reasons for Schelling's Nobel Prize award is his propensity to consider aspects neglected by the existing theory and to develop new concepts and analytical tools, thereby extending the scope of economic analysis.

One of his main contributions is a wider interpretation of the concept of rationality and rational behavior. Even if Schelling has always claimed that his work belongs within the boundaries of the perfect rationality approach, close inspection of it reveals a more complex idea of human rationality.

Starting from his *Strategy of Conflict* (1960) and continuing with his later studies on substance abuse and habitual behavior, until his last *Strategy of Commitment* (2006), it seems possible to outline an evolving concept of rationality. Individual rationality is described as a *collection of attributes*, and individuals are considered to be involved in two different levels of strategic interaction: the first taking place within individuals, among the different selves that people seem to embody, and the second referring to social interaction.

This paper reconstructs Schelling's idea of individual rationality and highlights the importance of his work in explaining the microfoundations of individual and social behavior. It also argues that Schelling's studies on rational (irrational) behavior enlarge the analytical spectrum of economic research. Finally, it suggests some theoretical and methodological implications of Schelling's theory of rational behavior for increasing the positive and normative power of economic models of social interaction.

Keywords

Rational Behavior; Decision Making; Multiple Selves; Schelling; Cognitive Economics

Introduction

The decision made by the Royal Swedish Academy of Sciences to award a Nobel Prize to Robert Aumann and Thomas C. Schelling was taken for many reasons. Firstly, Aumann and Schelling had extended the range

of application of game theory to many major issues in the social sciences; secondly they had focused their research on aspects neglected by standard economic theory. Finally, they had developed new concepts and analytical tools and extended the scope of economic analysis. Their work had given wider interpretation to the concept of rationality, making behaviors usually classified as irrational understandable (The Royal Swedish Academy of Sciences, 2005).

This statement points out Schelling's most distinctive feature: his propensity "to think about the essence of phenomena", his ability to see in everyday behavior "patterns and paradoxes that others overlook" (Zeckhauser, 1989, p.153).

Schelling's career started in a quite ordinary way. His first articles were published in *Econometrica* (1946), the *American Economic Review* (1947, 1949), and the *Review of Economics and Statistics* (1948); But at the end of the 1950s, when he joined the RAND Corporation as an adjunct fellow, Schelling was no longer a conventional economist but already "Something Else" (Zeckhauser, 1989, p.156). In his opinion, economic behavior involves complex phenomena and the analysis of social behavior cannot be separated by the analysis of individual behavior (Ambrosino, 2006).

During his long career, Schelling has involved in many different research programs ranging from strategic interaction to studies on substance abuse. Each of them has contributed to enlarging Schelling's array of tools with which to understand reality.

This paper will argue that Schelling's concept of individual rationality is the link between his analysis of social strategic interaction and his research on individual behavior. In particular, it will suggest that Schelling's theory can be reconstructed through three main phases in his work (Schelling, 1960, 1984a, 2006).

Some of Schelling's research results at Rand are set out in his *The Strategy of Conflict* (1960), and they correspond to his first main scientific interest: strategic interactions. In this book, he focused on international relations and the avoidance of nuclear war through arms control and careful strategy; but he was more generally interested in analysing every kind of situation in which individuals face interdependent choices.

Although *The Strategy of Conflict* is mainly concerned with individual interaction at the social level, Schelling's decision to deal with this topic using tools provided by game theory initially obliged him to clarify his opinion on the standard assumption of agents' perfect rationality. In Schelling's book, the perfect rationality assumption seems to be considered an extremely helpful starting point for understanding the complexity of the cognitive processes which enable individuals to coordinate their behavior. Indeed "decision makers are not simply distributed along one dimensional scale that stretches from complete rationality at one end to complete irrationality at the other. *Rationality is a collection of attributes*, and departures from complete rationality may be in many different directions" (Schelling, 1960, p. 16, emphasis added).

During the 1970s, Schelling involved in a new research program which took him rather distant from his previous scientific interests. In those years, he was invited to join a committee of the National Academy of Sciences on Substance Abuse and Habitual Behavior.

Some of the papers that Schelling wrote during this period were subsequently collected in his *Choice and Consequence* (1984). The main purpose of this book is to analyse individual behavior in different contexts, investigating the psychological elements that contribute to shaping individual choices.

In these papers, Schelling seems to suggest that perfect rationality cannot explain human behavior; on the contrary, individuals are more than simple rational maximisers. They seem to be made up of more than one self. Economists must consider choices as primarily the consequences of the strategic interaction taking place within subjects among different selves. It is important to point out that although Schelling describes himself as being in favour of the perfect rationality approach, he seems to have been aware of the complexity and the importance of the cognitive determinants of individual behavior. This awareness induced Schelling to maintain that scientists should

study both the strategic interaction taking place within subjects and strategic social interaction by analysing cognitive processes and how they contribute to shaping individual behavior.

Schelling's *Strategies of Commitment* (2006) seems to make this point clear. The book is a collection of papers resulting from different past research projects. The aim of all of them is to highlight the importance of commitment in both social strategic interaction and intra-strategic interaction. This last book seems to complete Schelling's theory of human behavior by finding a possible explanation of the two different levels of interaction in commitment behaviors (and self-commitment). In shaping their own behavior, people seem to apply themselves to the same strategy that they use to solve situations of social interaction implying interdependent choices.

The aim of this paper is to investigate Schelling's contribution to explaining the microfoundation of economic behavior. It is organized into two sections. Section one presents the main features of Schelling's rationality concept. It suggests a three-step path (Schelling, 1960, 1984a, 2006) which leads to the strategy of commitment as the interpretative key to Schelling's theory of interdependent decision, as well as the main feature of his theory of individual behavior.

Section two maintains that Schelling's theory of human rationality has major implications for all his economic research. It will be argued that the notions of rationality as a *collection of attributes* and individuals as a *small collectivity* not only have major theoretical implications for the study of social interaction but also entail important methodological considerations.

Finally, some concluding remarks are provided on the links between Schelling's theory and the development of economic theory under the perspective of cognitive economics.

Commitment and Self-commitment: the Way out of Social and Intra Strategic Interaction

In all his scientific research, Schelling deals with the complexity of the relationship between the rational and irrational¹ components of human behavior. This

¹ Schelling defines as irrational all the behavior determinants that cannot be considered as resulting from pure logical reasoning (Schelling, 1960).

paper will argue that, starting from Schelling's *Strategy of Conflict*, it is possible to find important contributions on this topic in his later works.

Because of his distinctive concept of rational behavior, Schelling has very often been considered a "dissenter" compared with mainstream economics (Steelman, 2005). Some authors have considered him a precursor of behavioral and cognitive economics, for two reasons: he has been one of the first scholars to apply an experimental approach to economic analysis; secondly, because when studying substance abuse he emphasised the importance of the emotional and cognitive determinants of individual behavior (Cowen et al., 2005).

Indeed, the richness of his contributions, the originality of his methodological approach, and his awareness of the limitations of the perfect rationality assumption, all suggest that Schelling's work does not pertain to standard economics. Nevertheless, he has always described himself as a proponent of the perfect rationality approach (Schelling, 1984a, 2006; Steelman 2005).

This statement is rather surprising in light of Schelling's theory of focal points² (1960) and his studies on self-command (1984a, 2006). But we should bear mind what Schelling writes concerning the perfect rationality approach: "rational choice...is a wonderful tool if used when appropriate, but it may not work all the time. So I consider myself in the rational-choice school, absolutely. But I'm more interested in the exceptions than many other economists tend to be"(Steelman, 2005, p.37).³

² Schelling (1960) pointed out that, in the analysis of coordination problems such as tacit and explicit bargaining, it is the context, the situation itself, which provides a clue making people's behavior converge on a common solution which he calls a *focal point*. This not only seems to be true in simple coordination contexts, but "there is so much evidence that such influence is powerfully present even in explicit bargaining"(Schelling, 1960, p.67).

Schelling stressed that an important role in determining focal points is played, not by logical reasoning, but by imagination (1960).

³ Schelling's position in Steelman (2005) is perfectly coherent with the one that he asserted twenty years previously in the preface to *Choice and Consequence*: "like most economists I am attracted to this model [rational behavior], at least as a benchmark, because when it works we get a lot of output from minimal input using a standard piece of intellectual machinery. I have been intrigued by cases in which that model seems not to work well..."(Schelling, 1984, p.X). The same assertion is reprinted in Schelling's *Strategy of Commitment* preface (2006, p.IX).

However, the purpose of this paper is not to discuss what research approach should be ascribed to Schelling. Throughout his work, Schelling has developed a concept of rationality that suggests the existence of a cognitive decision process in which many different determinants are simultaneously involved.

The first step of the theoretical path bringing Schelling to his concept of individual rationality is represented by *The Strategies of Conflict*. In this book Schelling describes interdependent decision problems through bargaining games. At first sight, he seems to share the perfect rationality assumption usually applied to players in game theory. Moreover, what he terms 'rational behavior' has already anticipate what he explicitly stated later in "What is Game Theory" (Schelling, 1984b). In Schelling (1984b), the perfect rationality assumption was considered a limitation of game theory and of "any theory that tries to deal with the full multidimensional complexity of imperfect decisionmakers" (1984b, p.239).

Schelling argued that the rational behavior assumption is a useful tool for describing a systematic theory of strategy,⁴ but it may also cause serious problems in explaining actual behavior: "if our interest is to study actual behavior, the result we reach under this constraint [rational behavior] may prove to be either a good approximation of reality or a caricature. Any abstraction runs a risk of this sort, and we have to be prepared to use judgement with any result we reach" (Schelling, 1960, p.4).

Schelling's analysis of strategic interdependent choices suggested that the assumption of purely rational agents may be somewhat reductive because it does not allow consideration to be made of the great weight of psychological, sociological, cultural and emotional components in shaping individual behavior.⁵ If the

⁴ Schelling considers interaction to be characterised by different levels of conflict. This conflict must be solved through strategic behavior. It is for this reason that a theory of strategy is needed. (Schelling, 1960).

⁵ Schelling's idea of irrational behavior seems rather different from Simon's concept of bounded rationality.

Simon pointed out that people are not perfectly rational because they have limited information and are subjected to cognitive and computational limits (Simon, 1955, 1956). The existence of those limits implies that agents cannot maximise in all circumstances. Decisions depend on human ability to simplify problems by splitting them into sub-problems and on the ability to elaborate heuristics to reach a satisfying outcome (Simon, 1972). This decision process is not similar to Schelling's. Nevertheless, the two

aim is to build a theory of strategy describing how agents rationally evaluate their choices in relation to their value systems, then it is necessary also to analyse possible implication of irrationality in agents' behavior. As Schelling pointed out, in the real world, agents cannot be simply divided into purely rational and irrational ones. Rationality is a "collection of attributes and departures from complete rationality may be in many different directions"(Schelling, 1960, p. 16, emphasis added). The process by which information is evaluated, the value system, and the way in which individuals interact and communicate with each other are all elements of what Schelling terms "irrationality".

Nevertheless, there are two cases in which the rational behavior assumption may be considered less restrictive and, in Schelling's opinion, perhaps more useful. Firstly, he argued that in the real world it is possible to find evidence of an intuitive appreciation of the principles of strategy, or at least of particular applications of them, also in certified irrational subjects, that is, subjects suffering from mental illnesses⁶.

The second case can be considered as somehow counterbalancing the first one. On considering an explicit theory of rational choice, and the strategic consequence of such choices, it is clear that it is not always an advantage in situations of conflict to be absolutely rational in deciding and motivating. Schelling gives many empirical examples⁷ of conflict situations in which searching for a solution with pure logical reasoning is a strategic disability. There are circumstances in which, even if it seems paradoxical, a conflict's resolution depends on the ability to suspend or limit rationality. A systematic theory can provide insight into individual behavior only if it is able to point out even the paradoxical role of rationality

(Schelling, 1960).

Thus we have focused on the relationship between rational and irrational behavior as Schelling described it in *The Strategies of Conflict*. However, his theory evolved and developed in light of the results of the research programs on which he worked during the 1970s.

In those years Schelling was asked to join a committee of the *National Academy of Science* to study *Substance Abuse and Habitual Behavior*. He was the only economist in a group of scholars specialized in different types of addictive substance. All the scholars seemed to take it for granted that if subjects were addicted to some kind of substance, there was little that they could do for themselves.

From 1992 until 1997, Schelling were involved in a working group on Addiction.⁸ The results of this research were collected in *Getting Hooked: rationality and addiction* (Elster and Skog, 1999). Contrary to the view that addicts are subject to compulsive urges, the authors in this volume suggested that addicts are capable of making choices.⁹ Nevertheless, this ability did not mean that addiction was the result of rational choice, as argued by Becker and Murphy (1988).

In his "Self-command in Practice, in Policy and in a Theory of Rational Choice" (1984b),¹⁰ Schelling points out that addiction is a major determinant of consumer welfare. He stressed that a theory based on stable preferences and rational choice cannot explain such

authors seem to share the same awareness of the importance of the individual ability to perceive clues that enable them to solve decision problems not only by simple rational reasoning.

Schelling's idea of agents as something more than rational players, characterised by the coexistence of rational decision processes and irrational ones, seems to have links with Kahneman's description of the distinction between intuitive and deliberate thought processes in decision making (Kahneman, 2003).

⁶ Some years later Damasio (1995) inquiry points out that emotion is essential to rational thinking and to normal social behavior by investigating a series of case studies. He demonstrates that people affected by brain lesions can be more rational in their choices than normal people.

⁷ See Schelling 1960, chapter 3.

⁸ The research group was founded by the Norwegian Research Council, The Norwegian Institute for Alcohol and Drugs Research, The Norwegian Directorate for Prevention of Alcohol and Drugs Problems and The Russell Sage Foundation. The research involved: Jon Elster, Thomas Schelling, George Loewenstein, Ole-Jorgen Skog, Karl Ove Moene, Olav Gjelsvik, George Ainslie, Eliot Gardner, James David, Hegel Waal.

⁹ Not all of the behaviors to which we can refer as addiction seem like consumer choices. Nevertheless there are many such behaviors that are indeed consumer choices: smoking, drinking, overeating, procrastination, licit or illicit drugs and shopping binges. These cases are particularly interesting for economists. Understanding addiction means dealing with the fact that there are people who wish so badly to avoid the consumption of certain goods that, if they could, they would put those commodities beyond their own reach. (Schelling, 1984b, p.4).

¹⁰ In reviewing Schelling's theory in sections I and III, we referred mainly to some of Schelling's works as he collected them in 1960, 1984 and 2006. This choice was due to the fact that, by collecting his papers, Schelling helps the reader understand how his theory evolved and what the main points in his inquiry are. When analysing the link between Schelling and Elster, we should consider their works with reference to the time when they were published.

behavior. He suggested that there were interesting works on how time preferences can change in the course of time (Schelling, 1984b, p. 6). He had in mind attempts to fit self-control both within the economic tradition (Stigler and Becker, 1977)¹¹ and outside that tradition. Nevertheless, he suggested looking at changes in preferences from a broader perspective. Changes are not unidirectional over time, and they may entail both bilateral and unilateral strategies.

Schelling started to form his own personal opinion on observing real situations in which addicts were able help themselves in avoiding a relapse. He concluded that numerous addicts seemed to have “two selves”, one that desperately wanted to consume the substance to which they were addicted, and one that desperately wanted not to consume it because it might ruin their lives and families : “it's as if those people have two different core value systems. Usually only one is prominent at a given time, and people may try to make sure that the right value system attains permanence by taking precautions that will avoid stimulating the other value system”(Schelling, in Seelman, 2005, p.2). Starting from this first experience, Schelling went on to develop his concept of individual rationality.

Choice and Consequence (1984a) developing some of the concepts has already presented in *The Strategy of Conflict*. What Shelling suggests is that a human being is something more than a single rational individual: when facing with decisions, agents are more similar to a *small collectivity*.¹² Thus conflict and strategic

¹¹ Stigler and Becker (1977) sought to fit self-control into the economic tradition, but their formulation denied the phenomenon that Schelling discussed (Schelling, 1984b).

¹² Almost in the same years when Schelling was developing his idea of agents' decision-making processes as an interaction among the members of a small collectivity, many others scholars studied strategic behaviors and pointed out something similar.

Harsanyi (1955) introduced the idea that individuals have simultaneously both subjective and ethical preferences. Sen (1977) suggested that agents have different, not commensurable and not comparable preference sets aimed respectively at satisfying moral and private interests. Margolis (1982) started from Sen's contribution to define the individual as a *dividual self* characterized by two different utility functions, one referring to personal interest and the other to the utility deriving from altruistic choice. Steedman and Krause (1986) considered the same issue and simply assumed that in daily life agents perform different roles, each of them related to a different utility function. However, the utility approach applied by those authors seems not to have been a satisfactory analytical framework because it did not allow consideration of the internal conflict among the different components of the individual (Davis, 2003).

interaction take place not only among individuals but also internally to each one of them: “conflict occurs not only when two distinct human beings choose together but also within a single one; and individuals may not make decisions in accordance with the postulate rationality, if by individuals we mean live people” (Schelling, 1984a, p.93).

From Schelling's words it seems that agents in their ordinary lives experience two levels of interaction, one of which (the social level) reproduces the main features of the other (the inner individual level). Schelling argued: “if we accept the idea of two selves of which usually only one is in charge at any time, or two value systems that are alternate rather than subject to simultaneous and integrated scrutiny, ‘rational decision’ has to be replaced with something like collective choice. Two or more selves that alternatively occupy the same individual, that have different goals and tastes, even if each self has some positive regards for the others (or one feels positively and the other does not reciprocate), have to be construed as engaged not in joint optimization but in a strategic game” (Schelling, 1984a, p.94).

From what was said above, it seems possible to identify a certain continuity between the theoretical content of *The Strategy of Conflict* and *Choice and Consequence*. In the former book, Schelling focused on conflict in interdependent decisions, while in the latter he stressed the importance of analysing intra-individual interaction among different selves. Each level of interaction manifests the limits of the perfect rationality assumption in explaining actual behavior. The rational behavior assumption, in fact, is not always able to explain either how agents reach a common outcome in conflicting interaction or why agents are able to control their own rationality in many situations .

The final step in Shelling's theory of rational behavior is represented by his last book *The Strategy of Commitment* (2006). Also this book is a collection of previous works produced during Shelling's career. Returning to issues on which he had worked for forty-five years, he decided that the key element in solving both social interdependent decisions and intra-individual interaction is the strategy of commitment (and self-commitment). In the preface, in fact, he reiterates his argument in *The Strategy of Conflict*: “commitment is central to promises and threats, to bargaining and negotiation, to deterrence and arms

control, to contractual relations".¹³ He thus suggests the centrality of strategic behavior in solving many different interdependent decision problems. Nonetheless, he points out that commitment also plays a crucial role in another area of strategy: commitment is one of the ways in which people try to govern their own behavior. He wrote "I had earlier considered commitment as central in influencing the behavior of others; it dawned on me that people attempting to control their own behavior often appeared to succeed when they managed to commit themselves to a regime of abstention or performance, treating themselves the way they might treat someone else" (Schelling, 2006, p. IX).

To conclude, it seems that on reviewing all Schelling's work from *The Strategy of Conflict* to this last book, it is possible to identify a path that led him to point out the symmetry between inter-individual and intra-individual interaction. It is indeed this feature which suggests that economists should conduct their research on decision making not only from the perspective of the perfect rationality assumption but also, and especially, by paying attention to behavioural deviations from it. Schelling (1984a) pointed out that formal models can be attractive, but he had always been more interested in behavior that rational models fail to explain.

On reviewing Schelling's main contributions, it seems possible to identify two main arguments to support the discussion on the methodological implications of Schelling's work for economics.

Firstly, Schelling emphasised that large part of actual individual behavior deviated from the standard assumption on perfect rationality. This does not mean that, in those cases, agents are unable to choose. It simply means that choices are not based on pure logical reasoning alone. Schelling observed that irrational behavior was important in determining both interdependent choices and intra-individual strategic choices. He studied the two levels of interaction separately and applied different theoretical tools to them. In fact, when Schelling studied inter-personal interaction by means of game theory (1960), he analysed intra-individual interaction through the

observation of actual behavior¹⁴ (1984a, 1984b). Schelling's theories of social interaction and inter-individual interaction influenced the later inquiry into economics. As it will be argued in the next section, Schelling's analysis of intra-individual and social interaction has important methodological implications. His inquiry developed within the framework of game theory has been fundamental for the development of behavioural game theory (Camerer, 2003). Moreover, his analysis on the cognitive processes involving in the intra-individual interaction has been considered a pioneering contribution to the development of a cognitive theory of human behavior (Ambrosino, 2006, 2008), and it has been of particular importance in the development of study on change in preference (Cameron, 1996) and of addiction (Frank, 1996).

The second aspect is closely dependent on the first one. In Schelling's theory of rational (irrational) behavior, in fact, there are significant attempts to enlarge the boundaries of the perfect rationality approach.

Schelling stressed the importance of the psychological and sociological components of individual behavior. This awareness was probably also due to his participation in research programs on items related to irrational behavior and which involved scholars working in different disciplines.

As it has already said, Schelling considered his work as belonging within the perfect rationality approach. Nevertheless, we will argue that his theory of rational behavior has major methodological implications. The results that Schelling obtained from his research on irrational behavior, in fact, show that formal models can only partially explain actual behavior. Schelling seems to suggest that economics must deal with irrational behavior and apply an interdisciplinary approach if it wants to explain real people's behavior (1960, 1984a, 2006).

Studying Economic and Social Behaviour: Schelling's Contribution to Cognitive Economics

The previous section has described the complexity of Schelling's theory of rational behaviour. More precisely, section one suggested that even if Schelling considered himself as adopting the perfect rational approach, his interpretation of the concept of 'rational' behaviour

¹³ Schelling's idea of commitment was first developed in "An Essay on Bargaining" (1956). In the same year also Strotz dealt with the same topic. But while Schelling's paper had an immediate impact on economics and political science, this was not the case of Strotz's (Crawford, 1991).

¹⁴ Schelling studied intra-individual interaction by investigating its psychological and strategic components (1984a, 2006).

induced him to expand the boundaries of standard economics to encompass analysis of deviations from rational behaviour.

It will be now argued that awareness of the complexity of human behaviour is also the cornerstone of Schelling's methodological considerations. Also with respect to methodology, it is possible to find two levels of analysis throughout Schelling's work. In *The Strategy of Conflict*, and in "Experimental Games and Bargaining Theory" (1961), he pointed out the limits of the standard theory, especially in regard to standard game theory, and suggested that moving to less formalised and empirical-experimental analysis would enable economists to take better account of the complexity of actual behaviour in social interaction.

Besides these explicit remarks, Schelling's works on substance abuse, habitual behavior and consumption (1984, 2006) developed an important analysis on the role of cognition in individuals' choices. Schelling stressed the need to think about whether and how individual complexity could be accommodated in models of rational choice. As Klein, Cowen and Kuran wrote "Schelling has always displayed an absolute independence from the trend toward formalisation" (2005, p. 159). This distinctive feature of Schelling's approach to economics has already been entirely evident in his analysis of strategic interaction (1960). With *The Strategy of Conflict* he furnished "fundamental game theory insights to political science, psychology, and sociology long before core economists found that conjectural equilibria and commitment difficulties were central to [economics]" (Zekhauser, 1989, p. 154).

In this book, Schelling developed his theory of strategic interaction using the framework provided by game theory. However, his theory of focal points underlines "irrational" aspects in coordination processes and bargaining choices and enables Schelling to offer a new interpretation of game theory as a less formalised tool useful in all the social sciences. He suggested that it was necessary to reorient game theory because "stories should be about human beings, not mere utility function, and....formalization, while fruitful in some respect, tends to kill key human qualities".¹⁵ To

Schelling's mind, strategic interaction is most of all based on a mutual perception and interpretation of environmental clues. Deciphering both kinds of elements requires something different from a formal model. Nevertheless, Schelling is far from rejecting the tools of standard game theory. In *The Strategy of Conflict*, the methodological discussion came after his theory of interdependent decision and strategic behavior; that is, after he applied both game theory tools and empirical analysis. This discussion stresses that, because of the complexity of human behavior, a strictly formal analysis of it may not be enough.¹⁶ However, Schelling stressed that "economists who know game theory are much better equipped to handle a lot of important questions than those who don't" but "economists who are game theorists tend to be more interested in mathematics aspects of the discipline than in the social scientific aspects" (Steelman, 2005, p.38). More recently, behavioural game theory has taken up most of Schelling's remarks on method. Behavioral game theory, in fact, applies game theory and experimental inquiry in order to correct the imbalance between theory and facts by describing strategic interactions (Camerer, 2003). It expands the analytical theory by adding emotion and cognitive peculiarity. It uses psychological insights to suggest ways to weaken rationality assumptions and, hence, extend the theory (Camerer, Loewenstein and Prelec, 2003). This approach emphasises the relationship between behavior and the environment, and it shows that pure theory predictions of what players will do, as Schelling wrote (1960), like proving that a joke is funny without telling it. If we consider jointly both the theoretical results that Schelling obtained in *The Strategy of Conflict* and his methodological remarks, they seem to suggest that he concludes from his studies that human beings are "open-end processes, and... theories should be populated by these open-end creatures. No machine or mathematical function can, by itself, approximate the human being" (Klein, Cowen, Kuran, 2005, p. 162). This last consideration seems to be all the more important in

¹⁵ Schelling (1960) suggests that there are three main elements in bargaining analysis which making a pure game theory approach unsuitable. Firstly, if the aim is to understand bargaining dynamics, it is not useful to concentrate on the payoff function. Secondly, studying bargaining in too abstract a way leads to its misinterpretation. Schelling stresses that, in most bargaining situations, stable outcomes are reached by means of environmental clues which are often not considered by standard models. Thirdly, mixed motive games must be studied also by means of empirical

analysis. This is because bargaining games involve two or more agents whose choices are strictly connected. This choice interdependence implies that something has to be communicated, at least some spark of recognition must pass between the players. This kind of "meeting of minds" should not be explained by axiomatic models (Schelling, 1960, p.163).

¹⁶ Both in *The Strategy of Conflict* and in "Experimental Games and Bargaining Theory" (1961), as well as in "What is Game Theory" (1984), Schelling suggests enriching standard theoretical models with empirical and experimental tools. See Ambrosino (2006).

relation to Schelling's later writings on self-command, self-management and self-commitment resulting from his research on substance abuse, habitual behavior and consumption. The description of the individual as a *small collectivity* induces Schelling to reflect on how to incorporate this phenomenon of inner individual strategic interaction into standard models of the rational consumer. This question appears to be purely rhetorical. Indeed, Schelling has stressed that most of the economics and philosophy literature addresses the presence of multiple selves within individuals as a problem of change in preference.¹⁷ Nevertheless, classic paradigms of rational choice are unable to answer whether or not it is rational to exercise our sovereignty by deciding to consume now what a few hours ago we stated we would not consume. As shown in section I, one of the characteristics of the two or more selves which populate human beings is that it is hard to get them to "sit down together" (Schelling, 2006, p.73). Analysis of the multiple selves using a rational consumer model shows that although each self represents a set of values, and although the selves share most of those values, there are always particular issues on which they differ. In these cases "there doesn't seem to be any way to compare their utility increments and to determine which behavior maximizes their collective utility" (Schelling, 2006, p.73). The conclusion that Schelling seems to reach from his inquiry is that the phenomenon of strategic interaction among alternating selves is a significant part of most people's decision-making processes. It cannot be left out of the description of a consumer: "we ignore too many important purposive behaviors if we insist on treating the consumer as having only values

and preferences that are uniform over time, even short periods of time" (Schelling, 2006, p.70). What Schelling proposes is to enlarge the spectrum of change in preferences considered by theory¹⁸ admitting "not only unidirectional changes over time, but changes back and forth at intervals of years, months, weeks, days, hours, or even minutes, changes that can entail bilateral as well as unilateral strategy" (Schelling, 2006, p.71). Achieving this objective requires studying the individual's actual behavior so as to understand the strategies and tactics that the different selves use to compete for command. Schelling's remarks on the complexity of intra-individual decision-making processes represent one of the main theoretical contributions on which the cognitive approach to economics has been developed in the past twenty years (Egidi and Rizzello, 2004, Ambrosino, 2006, 2008). The aim of cognitive economics is to understand human decision-making by applying an interdisciplinary approach. That approach enables investigation of deviations from standard rationality by applying the tools furnished by cognitive science, neuro-science, sociology, and many other research fields. This kind of investigation better explains the complexity of human behavior and its deviation from the standard economic assumptions. In the recent years cognitive economics deeply investigate individual decision processes under a perspective that is in close touch with Schelling's theory. Particularly Daniel Kahneman's work enlarges the spectrum of Schelling's investigation. Kahneman follows Schelling approach and his inquiry into the dual system of human mind shares the same methodological assumptions. As in the case of Schelling's theory, in fact, the cognitive theory of Kahneman and Tversky (1973a, 1973b, 1979, 1981), and the later inquiries of Kahneman (2003, 2011) are aimed at increasing the positive and the normative power of economic models enclosing economic theory by the analysis of systematic decision making processes. Nevertheless, exactly as previously argued referring to Schelling's theory, Kahneman's theory is not inside standard economics of rational agents but the perfect rationality assumption cannot be neglected. Cognitive theory applies an interdisciplinary approach to investigate cognitive biases in human behavior. The perfect rationality assumption, hence, represents the benchmark to which compare actual behavior. Cognitive economic research is aimed at

¹⁷ Strotz (1956) had already postulated something similar. He postulated an expectable change in individual preferences and suggested that people should solve this problem also by pre-committing future behavior: "An individual is imagined to choose a plan of consumption for future period of time so as to maximize the utility of the plan as evaluated at the present moment...If he reconsiders his plan at a later date, will he abide by it or disobey it even though his original expectations of future desires and means of consumption are verified? Our present answer is that the optimal plan of the present moment is generally one which will not be obeyed, or that the individual's future behavior will be inconsistent with his optimal plan. If this inconsistency is not recognised, our subject will typically be a "spendthrift"....If the inconsistency is recognised, the rational individual will do one of two things. He may "pre-commit" his future behavior by precluding future options so that it will conform to his present desire as to what it should be. Or, alternatively, he may modify his chosen plan to take account of future disobedience, realising that possibility of disobedience imposes a further constrainton the set plans which are attainable" (Strotz, 1956, p.166).

¹⁸ Schelling refers particularly to Strotz (1956), Phelps and Pollak (1968), Pollak (1968), Elser (1977,1979).

understanding human behavior that deviates from the standard economic models. The rise of the cognitive approach to economics is the result of a long history among economists of questioning the behavioral validity of the perfect rationality assumption and seeking alternatives¹⁹. Slowly cognitive economics moved from the perfect rationality assumption of the Chicago Man (Becker, 1976, Lucas, 1987) toward a new theory of rationality. The Kahneman- Tversky Man substitutes the standard model of *homo oeconomicus*. Kahneman's systematization of the distinction between intuition and reasoning seems today the best development of Schelling's theory of intra-individual strategic interaction. In the two system view (Epstein, 1994; Evans, 2008; Evans and Frankish, 2009, Kahneman and Frederick, 2002, Slovic, 1996; Stanovich and West, 2002) behavioral inconsistency is due to the coexistence of two type of cognitive processes. System 1 is that of intuition: its operations are fast, automatic, effortless, associative, and difficult to control or modify. System 2 is that of reasoning: its operations are slower, serial effortful, and deliberately controlled; they are also relatively flexible and potentially rules governed (Kahneman, 2003). Kahneman's (2011) discussion of the way in which System 1 and System 2 interact contribute to understanding the complexity of Schelling's intra-individual strategic interaction. Most of agent's actions in his ordinary life are basically related to intuition and do not involve the operations of System 2. People in real life act in order to minimize both their physical and their cognitive effort. System 2 activity is effortful while highly accessible impressions produced by System 1 control judgment and preference. Nevertheless System 2 can modify intuitive judgment and can determine changes in behavior but these changes imply a cost in terms of cognitive effort. Neuroscience demonstrates that there is a cognitive control of decision costs that plays a relevant role in preventing changes in behavior when they are perceived as excessively costly (McGuire and Botvinick, 2010). Dual system theory points out the complexity of individual decision making processes and contributes to explaining behavioral inconsistency and resistance to change. This theory makes a step forward Schelling's analysis of intra-individual strategic interaction and it shows the relevance of an interdisciplinary approach to investigate human

behavior. Moreover cognitive economics, seems to be aware of the relevance of Schelling's idea of the double level of interaction in which agents are involved (Ambrosino, 2006), and points out that it is not possible to investigate social interaction without understanding intra-individual strategic interaction. Particularly the cognitive theory of economic institutions underlines that it is not possible to investigate economic institutions and agents' behavior separately (Ambrosino 2006; North, 2004, Rizzello and Turvani, 2000, 2002). Focusing on Hayek's conception of the human mind as a spontaneous order much like the various social and economic phenomena he has explored in other works, cognitive economics investigates institutions as the outcomes of social interaction among heterogeneous agents (Ambrosino, 2006, 2008). As previously argued Schelling suggests that intra-individual interaction and social interaction are both governed by the same strategic dynamics (Schelling, 2006). He finds out in self-commitment and in commitment the focus of both level of interaction. Commitment in social interaction implies that agents try to interact in society following strategies of the same kind of those they use in intra-individual interaction. Moreover commitment requires that economic agents shape their mutual behavior focusing on mutual perception and the interpretation of environmental clues (Schelling, 1960). Cognitive economics has not fully explained how intra-individual strategic interaction contributes to the rise and development of social institutions and social behavior. Some attempts have been made to apply insight deriving from different research fields like anthropology and neurobiology to investigate how cognitive decision making processes are involved in institutional change (Ambrosino, 2012). Furthermore recent works try to apply a cartographic approach to investigate how heterogeneous agents react to different institutional contexts (Mitchell, 2003a, 2003b, 2004). This approach underlines the relevance of empirical observation to understand actual behavior. Schelling's discussion of methodological issues related both to research on social interaction processes and to decision-making highlights the great coherence which has characterised all his work. He never rejected the standard approach to economics, but his inquiry seems to aim at understanding actual behavior and actual interaction dynamics. From this point of view Schelling's contributions set a good example for further research because he suggested developing an interdisciplinary research approach (Ambrosino, 2006).

¹⁹ For a short survey of the history of behavioral and cognitive economics see Spada and Rizzello, 2012.

Some steps forward following Schelling's ideas have been done by cognitive economics, nevertheless his work still teaches us not to reject standard economics without evaluating the actual usefulness of its tools, and suggests that economics should never separate pure research from applied research because the "motivation for the pure theory came almost exclusively from preoccupation with (and fascination with) "applied" problems" (Schelling, 2006, XI).

Conclusions

This paper has analysed Schelling's theory of rational (irrational) behavior. In Schelling's works has been a highly distinctive analysis of individual behavior in which choice is considered the result of both rational and irrational components. Schelling has suggested that individuals are constituted by more than one self. The intra-individual decision process is also characterised by the coexistence of rational and irrational components.

Schelling pointed out the limitations of standard models in explaining decision-making processes, and he enlarged the scope of economic research by maintaining that scholars should be more interested in non-rational behavior. He suggested that economic agents were involved in two different level of interaction and that irrational behavior is important in determining both interdependent choices and intra-individual strategic choices.

Schelling's theory of rational (irrational) behavior not only has important theoretical implications but it also implies methodological implications. Schelling's theory of rational behavior, in fact, leads him to conclude that standard economic tools must be used more critically if the main objective of economics is to explain actual behavior.

Section II argued that Schelling's theory have relevant methodological implication because it points out that the analysis of decision making processes needs a less formalized and more interdisciplinary approach. The interdisciplinary approach is the distinguishing feature of the cognitive approach to economics (Innocenti, 2009). Section II has shown the links between Schelling's theory and the result recently obtained from cognitive economics. Particularly Kahneman's systematization of dual system theory provides a new explanation of what Schelling defines as the interaction among multiple-selves.

Although the relevance of this theory is not completely able to explain how intra-individual decision making processes can influence social interaction dynamics.

Cognitive economics of institutions points out that agents and institutions must be investigated in a joint framework but the relationship between individual decision making processes and the rise of institutions has not yet been completely explained. Much work remains to be done to investigate both individual decision making processes and social interaction.

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